

What Is Energy?

MAKE A CONNECTION

Horses are powerful animals that can run long distances at high speeds. Do you think these horses have energy? Why or why not?

FIND OUT ABOUT

- the science meaning of *energy*
- two main kinds of energy

VOCABULARY

energy, p. 4
kinetic energy, p. 5
potential energy, p. 6

Energy and Change

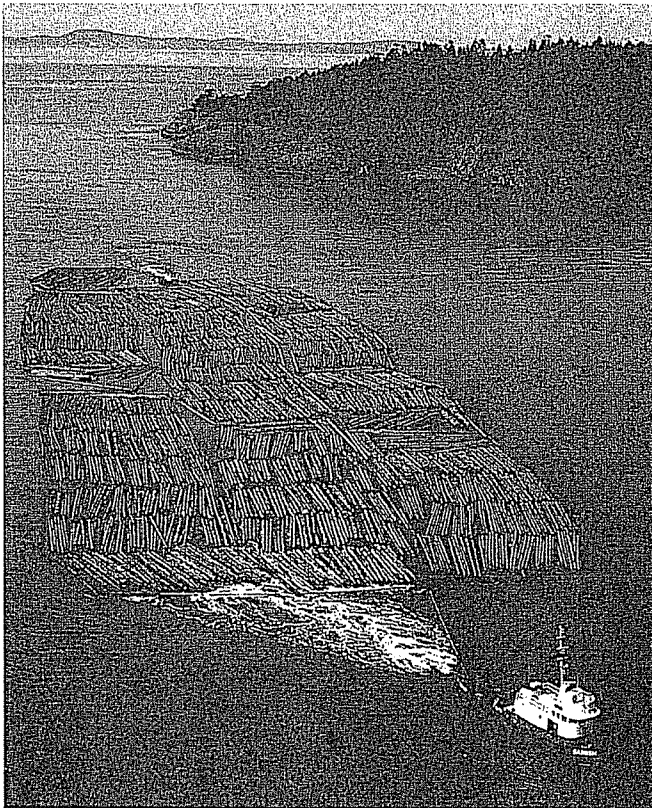
When you got up this morning, were you tired or did you have lots of energy? In everyday conversation, the word *energy* is often used to describe how active or lively someone or something is. In science, however, the word *energy* has a different meaning. In science, **energy** is the ability to make changes occur.

Movement is one kind of change. When things move, they change position. Walking, running, or kicking a ball are movements that require energy. We get the energy from food. A toy car's wheels spin because of energy from batteries.

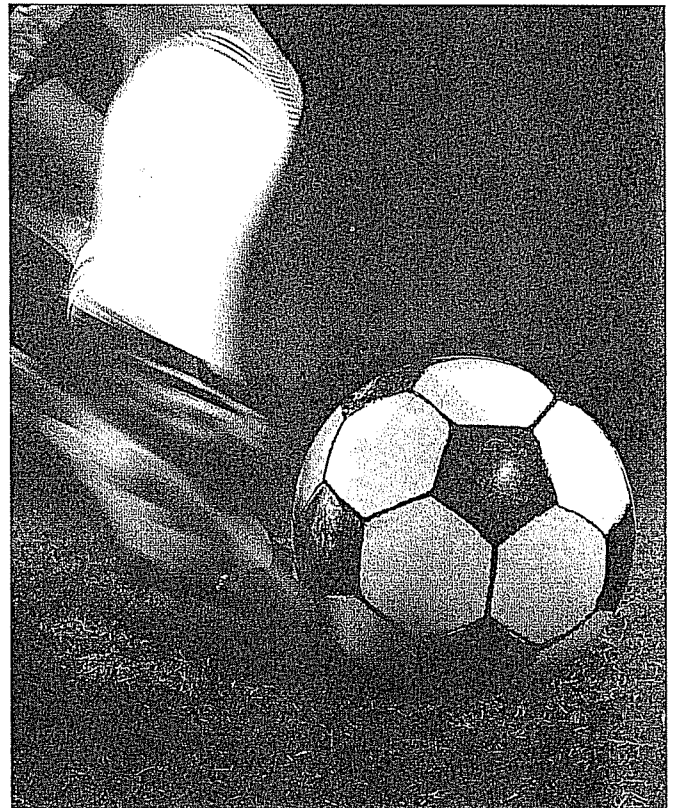
Growth is another kind of change. When things grow, they change in size. Plants grow and develop because of the energy they get from sunlight.

Changes usually occur because of the movement, or transfer, of energy. Energy can be transferred from one object to another or from one place to another. When you kick a ball, energy is transferred from your foot to the ball. If the Sun shines on an icicle, energy is transferred from sunlight to the solid ice, changing it to liquid.

✓ Give an example of energy being used to make a change occur.



▲ Changes, such as movement, involve energy. A tugboat gets energy from fuel to move itself and a load of logs up the river.



▲ When energy from a soccer player's foot is transferred to a ball, the ball moves along the playing field.

If a bus is in motion,
it has kinetic energy. ►



Kinetic Energy

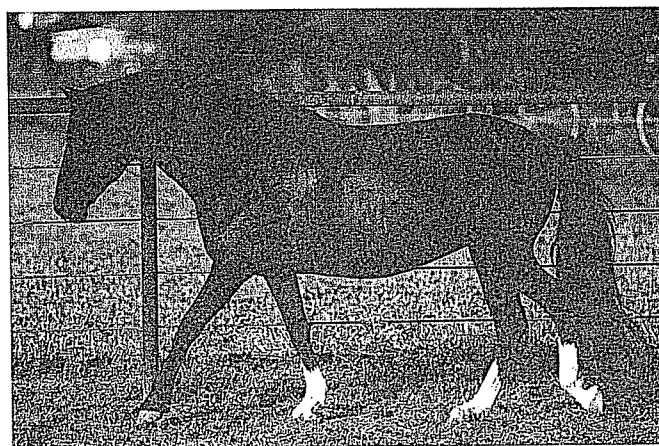
Scientists often use the words *kinetic* and *potential* to describe energy. Anything that is moving has **kinetic energy**, which is the energy of motion. Swimmers have kinetic energy when they move through the water. School buses have kinetic energy when they are rolling along.

Even the tiny particles that make up matter—anything that takes up space and has mass—have kinetic energy. You may know that all matter is made up of tiny building blocks called atoms. Two or more atoms are often joined together in units called molecules. Atoms and

molecules are always in motion, so they have kinetic energy.

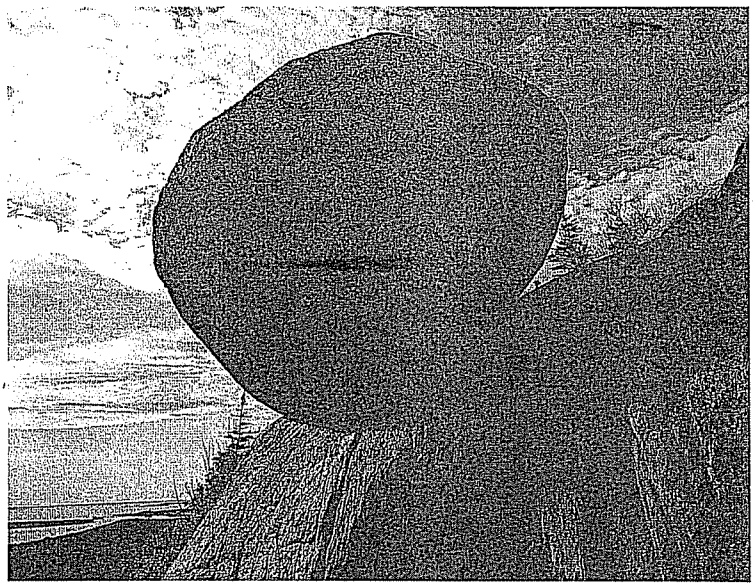
Two factors affect the amount of kinetic energy a moving object has: its speed and its mass. The faster an object moves, the more kinetic energy it has. For example, a horse has more kinetic energy when it is galloping than when it is walking. Together, a horse and its rider have more kinetic energy than the horse alone. The rider adds mass. The more mass a moving object has, the more kinetic energy it has.

✓ Which has more kinetic energy, a bird flying or a bird sitting on its nest? Explain your answer.



▲ The faster something moves, the more kinetic energy it has. The horse has more kinetic energy when it is galloping quickly than when it is walking slowly.

Objects can have energy even if they are not in motion. A rock on a cliff has potential energy. If the rock fell, it could break the rocks below and change them. ►



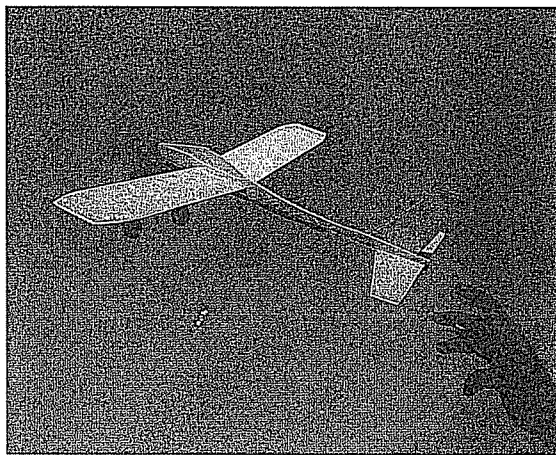
Potential Energy

Another kind of energy is **potential energy**, energy that an object has because of its condition or position. Potential energy is also called stored energy because it is not yet being used. No change is occurring at the moment, but it could at a later time.

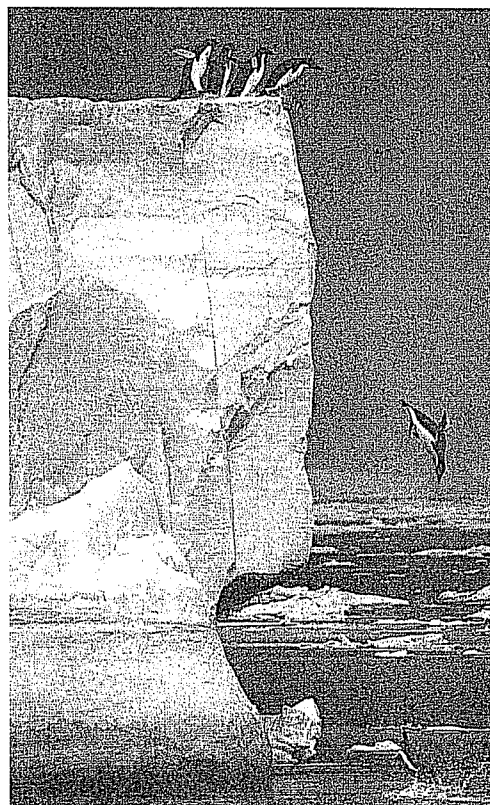
Objects that are stretched, twisted, or squeezed have potential energy because of their condition. Think about a rubber band that is stretched. If the rubber band were released, it could fly into the air.

The more the rubber band is stretched, the more potential energy it has, and the farther it may fly. A spring with its coils squeezed together also has potential energy.

Objects that are high up or off the ground have potential energy because of their position. The higher the object, the more potential energy it has. For example, a ski racer has more potential energy at the top of a mountain than near the bottom.



▲ Winding the propeller on this toy airplane twists a rubber band. A twisted rubber band has potential energy because of its condition. When the rubber band untwists, the propeller spins, and the plane flies.



◄ The penguins on top of the iceberg have the highest position. So they have the most potential energy.



▲ A roller coaster car has changing amounts of kinetic and potential energy, depending on its speed and its position.



▲ The mechanical energy of a swinging wrecking ball allows it to break through a strong brick wall.

Potential energy can change to kinetic energy, and kinetic energy can change to potential energy. At the top of a hill, a roller coaster car has mostly potential energy. As it begins to move down the hill, some potential energy changes to kinetic energy. As the car goes faster and faster, its potential energy decreases and its kinetic energy increases.

A swinging wrecking ball also has changing amounts of kinetic and potential

energy. Whether the energy is mostly kinetic or mostly potential depends on the wrecking ball's height and speed. However, the combination, or sum, of all the wrecking ball's potential and kinetic energy stays the same. The total energy of an object is known as its mechanical energy.

✓ At what point on the track does a roller coaster car have the most potential energy?

REFLECT ON READING

Describe something that is changing. Explain what is needed to make the change occur.

APPLY SCIENCE CONCEPTS

Imagine you are sitting at the top of a waterslide. Describe how your energy changes as you move down the slide. Draw and label a picture of what occurs.